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19. ABSTRACT (Continue on reverse if necessary and identify by block number)

Software quality tools were established as a MATE requirement by AFSC/AFLC 800-23. The delivered product will only work on version 3. of MCSS. These tools are highly labor intensive due to the large number of databases which must be manually input for each test program. ~~There is no movement at MATE SPO to update these tools.~~ The MAG ~~LSC~~ recommends that useful, supportable, and maintainable tools be developed or purchased for use with current MATE software.

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Report MAG 87-009-01

Software Quality Tools

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04 May 1988

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Final Report

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Prepared for
MATE Applications Group
WR-ALC/MAIT
Robins AFB 31098-5148

APPROVAL SHEET

Report ID: MAG 87-009-01

Title: Software Quality Tools

Author(s): Michael D. Stewart Date: 4 May 88

Date:

Date:

Standing Committee Chairperson: Ken Bingham Date: 4 May 88

Executive Committee Chairperson: Larry K. Israel Date: 21 Nov. 88

Preface

This report was written by members of the MATE Applications Group (MAG) to assist the Modular Automatic Test Epuipment (MATE) program.

MATE is an Acquisition Management program established by AFSC/AFLC regulation 800-23.

The MAG was established in recognition of the need for Air Force users to influence the application and future of MATE. This need was identified during the AFLC MATE Conference held at Wright Patterson AFB on 31 March 1987.

The ~~overall~~ objective of the MAG is to support and improve the MATE concept and programs. This will be accomplished by assessing the needs of the maintenance community and establishing a means of communicating those needs from the operating/user (maintenance) organizations to the managing/acquisition organizations.

This report must be considered in the context of the MATE program.

1.0 ISSUE:

Assuring Test Program Set Software quality in the MATE environment.

2.0 FACTORS BEARING ON THE ISSUE:

2.1 Background:

AFSC/AFLC 800-23 addresses the need for software quality with the Automated Quality Assurance Tools. These tools were delivered only last year. A detailed assessment was done by the MAG and is included as Appendices A through E.

3.0 CRITERIA:

3.1 QA Software Tools must provide a structured environment to assure that TPSs developed are capable, supportable and maintainable.

3.2 QA Software Tools must have minimum impact on MATE hardware resources.

3.3 Benefits of the QA Software Tools must be realized economically.

3.4 QA Software Tools must be "User Friendly".

3.5 QA tools must provide useful information about the test program's ability to test the UUT.

4.0 DEFINITIONS

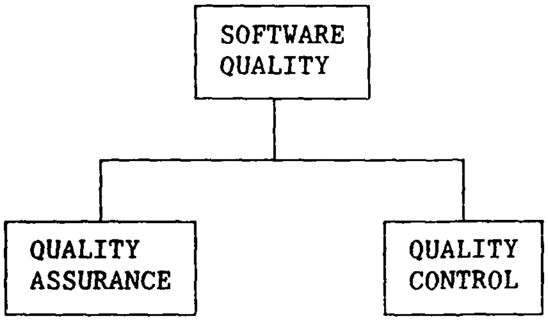
Quality Assurance - Quality Assurance controls the development process to insure a product will be built correctly.

Quality Control - Quality Control is an effort, after a product is complete, to insure that it meets quality standards.

5.0 DISCUSSION:

5.1 MATE Guides place major emphasis on the analysis of ATLAS programs after they have been developed (Quality Control). More emphasis is needed in the area of TPS development (Quality Assurance).

The Air Force as a whole is moving from Quality Control to Quality Assurance. The main reason for this thrust is the major savings possible by assuring something is done right the first time.



5.2 Some possible Quality Assurance Tools are:

1. ATLAS programmers need a language sensitive editor which will ensure that the syntax is correct.

2. Utility to re-number the ATLAS statements when tests are changed or added.

3. Utilities to automatically extract management data from the ATLAS code.

5.3 All Quality Assurance tools must be hosted off-line; this will result in better programs produced at a lower cost in less time.

5.4 Quality Control tools are also needed for use by the government to assure the quality of TPSs delivered.

6.0 ALTERNATIVES:

6.1 There exists in the commercial arena several software development packages which are designed to aid in the development and production of test program sets. Some of these are currently being used by the Military and by defense contractors to produce ATLAS programs. Others are being developed for future applications.

EXAMPLES:

1. TYX Corp. markets a software development package called PAWS. This package consists of approximately 30 individual application programs that perform the functions of ATLAS Subset and Test Station Database Processors, ATLAS Translation Processors, Test Executives, Editors, Documentation Tools, Management and QA Tools and a Menu Environment.

2. LEXICO also markets off-the-shelf software development packages to support a variety of testers currently in use by the DoD.

6.2 Acquire or develop Quality Assurance tools that could be provided GFE to all TPS developers. The advantage here is a standard process could be developed for all TPS development. If commercial products are used it is impossible to standardize due to competition laws. It potentially is the less expensive option, if good tools are developed!

7.0 CONCLUSIONS:

1) The existing MATE Automated Quality Assurance Tools are impractical.

2) Commercial products exist that will do most of the job.

3) GFE Quality Assurance tools could be developed.

4) The government should develop its own Quality Control tools.

8.0 RECOMMENDATIONS:

8.1 Do not use the current version of the MATE Software Quality Assurance Tools.

8.2 Encourage the use of commercial Quality Assurance tools while at the same time pursuing the development of some MATE Quality Assurance tools.

8.3 Develop practical MATE Quality Control tools. These must be government controlled to maintain uniformity and contractor integrity.

8.4 Require that all QA and QC Tools developed can be hosted and used on a multi-user, off-line host.

APPENDIX A

PRELIMINARY REPORT to the

MATE APPLICATIONS GROUP

LOGISTICS STANDING COMMITTEE

1. ISSUE:

Evaluation of QA Software Tools as delivered to SA-ALC.

2. FACTORS BEARING ON THE ISSUE:

2.1 Background: Four reference documents were used for this report.

2.1.1 MATE Application Group Initiative Traveler 87-009 was requested by WR-ALC/MAITC.

2.1.2 MATE Guide 5, vol. 3, part 7, sections 8 through 14 provide a description of the QA Software Tools.

2.1.3 MATE Guide 5, Volume 3, Part 11 provides the requirements for the test software design.

2.1.4 T.O. CFE 41 provides a preliminary users manual for the QA Software Tools.

2.2 Requirements: Test Program Set (TPS) QA Software Tools were designed to optimize the efficiency and applicability of a MATE ATLAS program, analyze fault isolation Ambiguity groupings, associated Flow Rates Ratios and Weighted Reliability Ratios, and report Test Accuracy Ratios. They were designed also to compare the TPS test limits to the UUT design limits as set forth in the Test Requirements Document (TRD) for the associated UUT. They were designed to support the quality assurance function in the areas of inspection, analysis, audit, and demonstration for the validation and verification of the TPS.

2.3 CRITERIA:

1. The QA Software Tools must provide useful information about the test program's ability to test the UUT.

2. The QA Software Tools should be economically advantageous.

3. The QA Software Tools should be easy to use.

4. The QA Software Tools should have minimum impact on the MATE test station efficiency.

2.4 Findings: Four of the tools have been released by ASD to SA-ALC MATE Operations Center:

MATE ATLAS Test Efficiency and Applicability program	(TEA)
MATE ATLAS Ambiguity Group Distribution program	(AGD)
MATE ATLAS Test Accuracy Ratio Evaluation program	(TARE)
MATE ATLAS Limit Comparison vs. Code program	(LCSC)

2.5 Facts:

2.5.1 The QA Software Tools require a MIL-STD 1750A computer with at least 64k word available memory, a disk drive, and a MATE keyboard/display terminal, a MATE line printer, and a MATE tape drive. The operation is facilitated by the MATE Operating System (MOS) and the MATE On-line Editor (MOLE).

2.5.2 The QA Software Tools were designed to analyze ATLAS test programs. This requires recognition of specific ATLAS keywords. A utility called BUILD is the process which facilitates this recognition. Prior to execution, BUILD requires the development of a keyword file. The keyword file contains an alphabetical list of ATLAS key words in the following classes: Verb, Noun, Modifier, Dimension and Modifier Descriptor. The format of the keyword file is illustrated in Appendix 1.

2.5.3 The instrument data base to be used for the operation of the TARE and LCSC QA Software Tools is test system dependent, and therefore needs to be generated once for that test system. It may then be used on all test programs that are developed for a particular application. A process called SBUILD is used to accomplish this. Prior to the execution of SBUILD, a data base file called the System Allocation Data Base file (sadb.in) must be generated. Each instrument in the test station is described in detail using ATLAS noun and noun modifier, ranges, tolerances, and dimensions of the modifier. The format for the SADB file is illustrated in Appendix 1.

2.5.4 Before the QA Software Tools can be executed, there are at least five database files which must be manually created according to specific format requirements for each tool. The procedures within each tool act on these databases and perform the reformatting of the data into binary output files. Examples of the database formats are included in Appendix 1. Appendix 4 lists the QA Tools and the input files required for each.

2.5.5 There are report and device options for each tool that may be used in specified combinations. Each option will produce a different report, or route the output file to a different device. Appendix 2 contains a list of the report and device options.

2.5.6 Certain programming limitations exist which must be considered prior to the execution of the QA Software Tools. Some limitations are global in nature while others are unique to a particular tool. A complete list of the limitations is in attachment 3.

2.5.7 The MATE ATLAS test program must be structured in accordance with the test software design guide MATE Guide 5, Volume 3, Part 11 with special attention given to the structure of QA comments and output message statements.

3.0 DEFINITIONS:

3.1 The TEA is designed to examine the efficiency and applicability of a MATE ATLAS test program. The execution of the TEA requires the development of a database file called the Reliability Data Base (RDB). The RDB file contains data that is specific to the UUT to be tested by the ATLAS Test Program. The data describes the UUT and the RUs contained within the UUT. The RDB is developed by a manual process consisting of a line-by-line examination of the ATLAS Test Program and UUT documentation extracting Statement numbers, Number of Pins, Pin Identifier Names, Number of Replaceable Units on the UUT, Replaceable Unit Identifier Name, Failure Rates of RUs, MTBF of RUs, Number of Failure Modes, Failure Mode Identification ("How-malfunction Code"), Failure Rate of Failure Mode, and MTBF of Failure Mode. The TEA generates an output file called "TEA.OUT". The contents of TEA.OUT is dependent upon the report option selected when the TEA is invoked.

3.2 The AGD program scans the MATE ATLAS Test program for Remove and Replace (R/R) directives to determine ambiguity group size within the test program and equates those figures to an acceptable predetermined group size. The AGD requires the development of two databases prior to execution, the Reliability Data Base (RDB), and the Ambiguity Standard Data Base (ASDB). The RDB file structure is identical to that required by the TEA. The ASDB input file contains data that describes the UUTs Ambiguity Group limits. The limits include the Ambiguity Group Size, acceptable Weighted Reliability Ratio (WRR), and acceptable Flow Rate Ratio (FRR). These elements are incorporated into the ASDB binary file via the procedure ASDBBLD. The AGD generates an output file called AGD.OUT. The contents of AGD.OUT is dependent upon report and output device options selected when the AGD is invoked.

3.3 The TARE program is designed to accept and scan a MATE ATLAS source code test procedure to determine if sufficient Test Accuracy Ratios (TARs) are utilized to ensure a reliable test of the UUT. The TARE requires the development of two database files: the System Allocation Data Base file (SADB) and the Source Data Base file (SDB). The SADB file is also used in the SBUILD utility. The SDB contains data specific to UUT pins. The data describes each pin by the ATLAS noun and noun modifier characteristics. Each modifier description contains the ranges, tolerances, and dimensions of the modifier. The report and Device options selected when the TARE is invoked determine the contents of the output file TARE.OUT.

3.4 The LCSC program is designed to determine if the MATE ATLAS test program limits are in accordance with those specified in the UUT Test Requirements Document (TRD). The LCSC program analyzes the requirements, procedures and programs to determine whether the stimulus and measurement limits of the coded MATE ATLAS program are in agreement or accordance with the design limits of the UUT. This analysis will determine if the programmed signals are within allowable ranges to provide proper stimulus to assure that measurements are such that bad UUTs will be rejected and that good UUTs will be accepted. The inputs to the LCSC are identical to those of the TARE program. Output is controlled by the output and device option selected by the user when the LCSC is invoked.

4.0 DISCUSSION:

4.1 Each tool has a variety of output options available to the user, however, the option must be selected when the QA Software Tool is first invoked. When additional data is desired from the particular tool being utilized, the tool must be invoked again. The tools would be more efficient with output options menu driven.
modules.

4.2 The QA Software Tools require that a number of databases be developed in order for them to function. They are hampered by the lack of programming aids in the generation of the databases. This is a serious shortcoming of the tools. There are at least five files which must be manually generated. With the exception of the System Allocation Data Base (SADB) used with the TARE and LCSC Tools, all the database files must be generated for each TPS. Manual generation of these files adds many hours to the development time for TPSs and makes them subject to errors. MATE documentation does not assign the responsibility for the writing of these files (i.e. Is it the responsibility of the TPS developer, the Quality Branch or the MM organization to see that the database files are available and accurate?).

4.3 The QA Software Tools require a 1750A computer host for their operation. Having the tools hosted on the 1750A results in increased loading of already critically short resources. Most of the editing of ATLAS code and compiling of ATLAS programs is being done on an off-line system. Putting the QA Software Tools on an off-line host would provide availability to many users simultaneously and relieve the loading of MATE testers. On 11 June 1986 WR-ALC/MAIT submitted a GIF suggesting this be adopted. So far there has been no response to the GIF.

4.4 Limitations of the QA Software Tools consist mainly of restrictions placed on the amount of data the QA Software Tools are capable of including in the analysis. Examples include the number of DEFINE, MESSAGE statements, number of RUs per ATLAS statement, length of character strings, etc. These restrictions come into play when developing TPSs that are very long. This is the time the QA Software Tools are needed the most. Short programs can be analyzed manually with efficiency.

5.0 CONCLUSIONS: There are strong arguments against the implementation of the QA Software Tools on the MATE Test stations.

5.1 The QA Software Tools will not work with MATE ATLAS programs that use digital stimulus patterns generated by HITS and other non-ATLAS modules.

5.2 The QA Software Tools are too labor intensive.

5.3 The operation of the tools does not allow flexibility in selecting the desired output option.

5.4 The QA Software Tools tie up production test equipment that is extremely expensive and already heavily loaded.

5.5 The QA Software Tools are not available in a multi-user environment.

6.0 RECOMMENDATIONS:

6.1 It is recommended that the requirement for QA Software Tools be suspended until such time as they can be demonstrated to perform efficiently.

6.2 It is recommended that industry be queried as to the availability of automatic QA Software Tools.

6.3 It is recommended that the QA Software Tools be reformatted to run on an off-line operating system.

APPENDIX B

QA SOFTWARE TOOLS

DATABASE FILE FORMATS

KEY WORD INPUT FILE FORMAT

Key Word Input file Description

The key word is the actual ATLAS key word as it appears in the ATLAS test program.

The class is denoted as follows:

VERB..................V
NOUN..................N
MODIFIER..............M
DIMENSION.............D
MODIFIER DESCRIPTOR....MD
OTHER..................O
PIN...................P

The attributes are as follows:

VERB NAME : V [: QA TOOL , QA TOOL (processing the verb)] $
MODIFIER NAME : M [: MD or DIG] $

Where the attribute field may contain a modifier descriptor or a digital modifier.

DIMENSION NAME : D [: [+/-] (conversion value) (base dimension)] $

Each line in the Key Word file ends with a dollar sign ($).

EXAMPLE

```
------------------------------------------------------------------
| Key Word : Class    [:  Attributes] $                           |
------------------------------------------------------------------
|    .                                                            |
------------------------------------------------------------------
|    .                                                            |
------------------------------------------------------------------
|    .                                                            |
------------------------------------------------------------------
|    .                                                            |
------------------------------------------------------------------
|    .                                                            |
------------------------------------------------------------------
|    .                                                            |
------------------------------------------------------------------
```

SAMPLE KEY WORD INPUT FILE

```
AC SIGNAL : N : $
BAUD : D $
CLOCK-IN : P $
DISPLAY : V TEA, AGD $
FUEL-SUPPLY : M : DIG $
GATE-START-SLOPE : M : DIG $
MWPRDS/SEC : D : 6 WORDS/SEC $
```

SYSTEM ALLOCATION DATA BASE FORMAT

SADB Input file Description

A. The first line of the file is the database name.

B. The next line is the number of Instruments. A number of blocks, equal to the number of instruments follows. Each block describes the instrument and its attributes. Each block must be preceded by a line consisting of only a dollar sign ($).

1. The first line of the block is the instrument name.

2. The next line of the block is the system designator. This describes the instrument type (e.g., sensor, source, load).

3. The next line contains the number of nouns. A number of blocks, equal to the number of nouns follows. Each block describes noun modifiers and other data associated with the noun.

a. The first line contains the number of noun modifiers associated with the noun. A number of blocks, equal to the number of modifiers follows. Each block describes the attributes of the modifier.

i. The first line contains the modifier name. If the name is enclosed in parentheses, it denotes a measured characteristic.

ii. The next line contains the system inaccuracy. This value must be expressed as a real number (no scientific notation). If pc follows the value, the system inaccuracy is taken to be a percentage.

iii. The next line contains the dimension. This is the type of units that the range and tolerance values are expressed in. A null may be input.

iv. The next two lines are for the range values. The first line is the the upper limit (UL) and the second line is the lower limit (LL). Both values must be expressed as real numbers.

v. The next two lines are for the tolerance values. The first line is the upper limit (UL) and the second line is the lower limit (LL). Both tolerance values must be expressed as real numbers. If pc follows the value, the tolerance is taken to be a percentage.

b. The last line of the file contains only a dollar sign ($).

SADB EXAMPLE

Database Name
Number ofInstruments
$
Instrument Name
System Designator
Number of Nouns
Noun
Number of Modifiers
Modifier
System Inaccuracy
Dimension
Range - Upper Limit
Range - Lower Limit
Tolerance - Upper Limit
Tolerance - Lower Limit
$
.
.
.
.

SAMPLE SYSTEM ALLOCATION DATA BASE (SADB) FILE

```
qasadbl.sadb      ;    * data base name  mate qa tool - tare and lcsc
     1            ;    * no. instruments *
$
   ftim           ;    * instrument name *
sensor            ;    * system designator *
     1            ;    * no. nouns *
ac signal         ;    * noun *
      5           ;    * no. modifiers *
(freq)            ;    * modifier *
      1 pc        ;    * system inaccuracy *
   hz             ;    * dimension *
    200e6         ;    * range - ul *
      0           ;    * range - ll *
      2 pc        ;    * tol - ul *
     -2 pc        ;    * tol - ll *
voltage           ;    * modifier *
      2 pc        ;    * system inaccuracy *
   v              ;    * dimension *
     50           ;    * range - ul *
    -50           ;    * range - ll *
      1 pc        ;    * tol - ul *
     -1 pc        ;    * tol - ll *
voltage-p         ;    * modifier *
      2 pc        ;    * system inaccuracy *
   v              ;    * dimension *
     50           ;    * range - ul *
    -50           ;    * range - ll *
      1 pc        ;    * tol - ul *
     -1 pc        ;    * tol - ll *
voltage-pp        ;    * modifier *
      2 pc        ;    * system inaccuracy *
   v              ;    * dimension *
    100           ;    * range - ul *
      0           ;    * range - ll *
      1 pc        ;    * tol - ul *
     -1 pc        ;    * tol - ll *
test-equip-imp    ;    * modifier *
      1 pc        ;    * system inaccuracy *
    ohm           ;    * dimension *
     50           ;    * range - ul *
     50           ;    * range - ll *
      0           ;    * tol - ul *
      0           ;    * tol - ll *
$
```

RELIABILITY DATA BASE FILE FORMAT

** DATABASE FILES ARE ASCII FILES **

RDB Input File Description

LINE ONE is the DATABASE NAME.

LINES TWO and THREE are for STATEMENT NUMBERS in the ATLAS program. the purpose is to exclude a block of code from analysis.

LINE FOUR will contain the NUMBER OF UUT PINS. A number of lines equal to the number of pins will follow with each containing the pin identifier name.

The next line will contain the total number of RUs. A number of blocks equal to the number of RUs will follow with each block preceded by a line containing only a $. (Either the FM or the FM MTBF may be replaced with the word 'null' but not both. These three-line groups are repeated until all FMs are described).

The last line of the file contains only a $.

RDB EXAMPLE

Database Name
Exclude From Statement Number
Exclude To Statement Number
Number of Pins
$
Pin Identifier Name
Pin Identifier Name
Pin Identifier Name
Pin Identifier Name
Pin Identifier Name
etc.
Number of Replaceable Units (RUs)
$
RU Name
Failure Rate (FR)
MTBF (Mean Time Between Failure)
FMs (Failure Modes)
Failure Mode ID (how malcode)
FM Failure Rate
FM MTBF
$
.
.
.
.

SAMPLE RELIABILITY DATA BASE (RDB) FILE

```
qardbl.rdb    ;   * data base name  mate qa tool - agd and tea
  050000      ;   * exclude from *
  099999      ;   * exclude to   *
     2        ;   * no. pins *
    jl-a      ;   * pin id *
    pt        ;   * pin id *
     2        ;   * no. replaceable units *
   $
     1        ;   * ru id *
  1000000     ;   * failure rate *
     1        ;   * mtbf *
     4        ;   * no. failure modes *
    450       ;   * failure mode id *
    null      ;   * fm failure rate *
     8        ;   * fm mtbf *
    615       ;   * failure mode id *
    null      ;   * fm failure rate *
     6        ;   * fm mtbf *
    626       ;   * failure mode id *
    null      ;   * fm failure rate *
     5        ;   * fm mtbf *
    748       ;   * failure mode id *
   null       ;   * fm failure rate *
     2        ;   * fm mtbf *
   $
   al0        ;   * ru id *
   100000     ;   * failure rate *
   null       ;   * mtbf *
     5        ;   * no. failure modes *
    169       ;   * failure mode id *
   666666     ;   * fm failure rate *
   null       ;   * fm mtbf *
    450       ;   * failure mode id *
   null       ;   * fm failure rate *
     2        ;   * fm mtbf *
    615       ;   * failure mode id
   725000     ;   * fm failure rate *
   null       ;   * fm mtbf *
    sa0       ;   * failure mode id *
   null       ;   * fm failure rate *
     7.5      ;   * fm mtbf *
    ssl       ;   * failure mode id *
   null       ;   * fm failure rate *
     8.2      ;   * fm mtbf *
   $
```

AMBIGUITY STANDARD DATA BASE FORMAT

The first line is the database name. The name should include .ASDB for identification purposes.

The next line contains the maximum ambiguity group size. This is the maximum replaceable units that may be in any ambiguity group.

The rest of the database consists of 3-line blocks, one for each ambiguity group. Each block is preceded by a $.

The first line of the block is the number of replaceable units in the ambiguity group. The next line is the Weighted Reliability Ratio. The next line is the Flow Rate Ratio.

The last line of the file contains only a $.

AMBIGUITY STANDARD DATA BASE FORMAT

Database Name
Maximum Ambiguity Group Size.
$
ambiguity group size
acceptable WRR
acceptable FRR
$

SAMPLE AMBIGUITY STANDARD DATA BASE (ASDB) FILE

```
qaasdbl.asdb        ;  * data base name  mate qa tool - agd *
      3             ;  * max ags *
$
      1             ;  * ags=1 *
    .70             ;  * wrr *
    .90             ;  * frr *
$
      2             ;  * ags=2 *
    .20             ;  * wrr *
    .06             ;  * frr *
$
      3             ;  * ags=3 *
    .10             ;  * wrr *
    .04             ;  * frr *
$
```

SOURCE DATA BASE FORMAT

SDB Input file Description

A. The first line of the file is the database name. The name should include .SDB for identification purposes.

B. The next two lines are for statement numbers in the ATLAS program. These must be six digit numbers or the word 'null'. The purpose of these elements is to exclude a block of code from the analysis.

C. The next line is the number of pins. A number of blocks, equal to the number of pins follows. Each block describes the pin and its attributes. Each block must be preceded by a line consisting of only a dollar sign ($).

1. The first line of the block is the pin name.

2. The next line of the block is the pin designator. This describes the pin type (e.g., in/out, in, out, none).

3. The next line contains the number of nouns. A number of blocks, equal to the number of nouns follows. Each block describes noun modifiers and other data associated with the noun.

a. The first line contains the number of noun modifiers associated with the noun. A number of blocks, equal to the number of modifiers follows. Each block describes the attributes of the modifier.

i. The first line contains the modifier name. If the name is enclosed in parentheses, it denotes a measured characteristic.

ii. The next line contains the ITA inaccuracy. This value must be expressed as a real number (no scientific notation). If pc follows the value, the ITA inaccuracy is taken to be a percentage.

iii. The next line contains the dimension. This is the type of units that the range and tolerance values are expressed. A null may be input.

iv. The next two lines are for the range values. The first line is the the upper limit (UL) and the second line is the lower limit (LL). Both values must be expressed as real numbers or NULL. If NULL is used, the nominal range value must be a non-NULL value. INFINITY may be input for either upper or lower limit, but not for both.

v. The next two lines are for the tolerance values. The first line is the upper limit (UL) and the second line is the lower limit (LL). Both tolerance values must be expressed as real numbers. If pc follows the value, the tolerance is taken to be a percentage.

vi. The last line of the block is the nominal range value. In come cases, a nominal range of 0 is possible. If NULL is input for the nominal range, the upper and lower limits must be non-NULL.

b. The last line of the file contains only a dollar sign ($).

SDB EXAMPLE

Database Name
Exclude From Statement Number
Exclude To Statement Number
Number of Pins
$
Pin Identifier Name
Pin Designator
Number of Nouns
Noun
Number of Modifiers
Modifier
ITA Inaccuracy
Dimension
Range - Upper Limit
Range - Lower Limit
Tolerance - Upper Limit
Tolerance - Lower Limit
Nominal - Range
$
.
.

SAMPLE SOURCE DATA BASE (SDB) INPUT FILE

```
qasdb1.sdb      ;     * data base name  mate qa tool - tare and lcsc
  050000        ;     * exclude from *
  099999        ;     * exclude to *
    1           ;     * no. pins *
$
    j1-a        ;     * pin id *
    in          ;     * pin designator *
    2           ;     * no. nouns *
dc signal       ;     * noun *
    2           ;     * no modifiers *
voltage         ;     * modifier *
    2 pc        ;     * ita inaccuracy *
    v           ;     * dimension *
    null        ;     * range - ul *
    null        ;     * range - ll *
   10 pc        ;     * tol - ul *
  -10 pc        ;     * tol - ll *
   28           ;     * range - nom *
current-lmt     ;     * modifier *
    1 pc        ;     * its inaccuracy *
    a           ;     * dimension *
    null        ;     * range - ul *
    null        ;     * range - ll *
   20 pc        ;     * tol - ul *
  -20 Pc        ;     * tol - ll *
    3           ;     * range - nom *
dc signal       ;     * noun *
    2           ;     * no. modifiers *
voltage         ;     * modifier *
    2 pc        ;     * ita inaccuracy *
    v           ;     * dimension *
    null        ;     * range - ul *
    null        ;     * range - ll *
   10 pc        ;     * tol - ul *
  -10 pc        ;     * tol - ll *
    5           ;     * range - nom *
current-lmt     ;     * modifier *
    1 pc        ;     * ita inaccuracy *
    ma          ;     * dimension *
    null        ;     * range - ul *
    null        ;     * range - ll *
   20 pc        ;     * tol - ul *
  -20 pc.       ;     * tol - ll *
    1           ;     * range - nom *
$
```

APPENDIX C

REPORT OPTIONS

TEA Report Options

r - "Test Program Applicability Ratio"
u - "UUT Replaceable Units"
f - "Failure Mode Testing"
o - "Pin Testing"
a - Includes Options r,u,f,o.
e - "Efficiency Measurement"
l - "Ordered Reliability"
h - Help option - displays all available options

Device Options

c - display report(s) at CRT and disk
d - display report(s) at printer and disk
s - send report(s) to disk only

AGD Report Options

a - "R/R and Their Test Numbers"
r - "R/R and Their RUs"
t - "Total R/R"
g - "MAX Group Size Exceeded"
f - "Flow Rate Ratio"
l - "Detailed Display"
x - Includes all the above options
h - Help option - displays all available options

Device Options

c - Display report(s) at the CRT and disk
d - Display report(s) at the line printer and disk
s - Send report(s) to disk only

TARE Report Options

t - "Detailed Display"
e - "Diagnostic Display" for statements whose TAR falls below
    user input TAR limit
i - "Interleaved Display"
h - Help option - displays all available options

Device Options

c - displays report(s) at CRT and disk.
d - displays report(s) at line printer and disk.
s - sends report(s) to the disk only.

LCSC Report Options

t - "Detailed Display"
e - "Diagnostic Display" for the signal statements whose tolerance band exceeds input limit.
i - "Interleaved Display"
h - Help option - displays all available options

Device Options

c - displays report(s) at CRT and disk
d - displays report(s) at line printer and disk
s - sends report(s) to disk only

APPENDIX D

LIMITATIONS

PROGRAM LIMITATIONS

GLOBAL LIMITATIONS

ATLAS IDENTIFIER - The maximum length of and ATLAS identifier or variable is 16 characters.

File names - The maximum length of a file name is 14 characters.

Path names - The maximum length of a 1750 path name is 250 characters.

Maximum AGS - The largest ambiguity group size allowed in the ASDB or ATLAS program is 100.

Buffer Size - The size in characters of the GETCHR input buffer is 50.

Conversion Size - The maximum size of a character string converted from a floating point or integer value is 15 characters.

Maximum Number of ATLAS procedures - The maximum number of procedures allowed in the ATLAS program is 20.

Maximum Number of Pins - The maximum number of pins per statement allowed in the ATLAS program is 32.

Maximum Number of Parameters - The maximum number of parameters to be passed in a procedural called is 20.

Connection Fields - The maximum number of connection fields in an ATLAS statement is 64.

Maximum Number of RUs - The maximum number of replacement units per statement is 6.

Maximum Number of FMs - The maximum number of failure modes per ATLAS statement is 10.

Maximum Number of Defined Messages - The maximum number of define messages in an ATLAS program is 32.

Maximum Number of Message Character Variables - The maximum number of message character variables in an ATLAS program is 20.

ATLAS Keyword Length - The maximum length of an ATLAS keyword is 24 characters.

TEA LIMITATIONS

FMs - The maximum number of failure modes that appear in the test program and do not appear in the reliability data base is 100.

ACD LIMITATIONS

Worst Case R&R for and AGS - The maximum number of equivalent worst case occurrences allowed for and Ambiguity Group is 50. Worst case is the R&R Directive with the worst FR from an Ambiguity Group.

TARE LIMITATIONS

Maximum Number of Instruments - The maximum number of qualifying instruments for an ATLAS signal statement is 20.

Maximum Number of Modifiers - The maximum number of modifiers for an ATLAS signal statement is 20.

Maximum Number of Nouns - the maximum number of qualifying nouns for an ATLAS signal statement is 20.

LCSC LIMITATIONS

Maximum Number of Instruments - The maximum number of qualifying instruments for an ATLAS signal statement is 20.

Maximum Number of Modifiers - The maximum number of modifiers for an ATLAS signal statement is 20.

Maximum Number of Nouns - the maximum number of qualifying nouns for an ATLAS signal statement is 20.

APPENDIX E

DATA BASE INPUTS/OUTPUTS

MATE QUALITY ASSURANCE TOOLS

DATABASE REQUIREMENTS

AGD OPERATION

INPUT FILES

RDB - Reliability Data Base

ASDB - AMBIGUITY Standard Data Base

OUTPUT FILES

RURDB.BIN

AUXRDB.BIN

AGD.OUT

MATE QUALITY ASSURANCE TOOLS

DATABASE REQUIREMENTS

TEA OPERATION

INPUT FILES

RDB - Reliability Data Base

OUTPUT FILES

RURDB.BIN

AUXRDB.BIN

TEA.OUT

MATE QUALITY ASSURANCE TOOLS

DATABASE REQUIREMENTS

TARE OPERATION INPUT FILES

SADB.IN - System Allocation Data Base

SDB - Source Data Base

OUTPUT FILES

SADB.DAT

AUXSAD.DAT

SDB.BIN

AUXSDB.BIN

MATE QUALITY ASSURANCE TOOLS

DATABASE REQUIREMENTS

LCSC OPERATION

INPUT FILES

SADB.IN - System Allocation Data Base

SDB - Source Data Base

OUTPUT FILES

SADB.DAT

AUXSAD.DAT

SDB.BIN

AUXSDB.BIN